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Assessment of ten-year risk of cardiovascular event using WHO/ISH risk prediction chart among adults in a tertiary care hospital in Puducherry, India

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Abstract

Context: The changing trends have revealed that cardiovascular disease (CVD) has evolved as prime cause of mortality globally, and predicting this prior is of utmost interest in patient management.

Objective: To assess the ten-year risk of fatal or non-fatal cardiovascular event using World Health Organization/ International Society of Hypertension (WHO/ISH) risk prediction chart among adults.

Material and methods: A cross sectional study was conducted among 226 general medicine Outpatient Department (OPD) attendees of a tertiary care hospital. Their risk of encountering a major cardiovascular event such as myocardial infarction or stroke ten year later was assessed using the WHO/ISH risk prediction charts. Appropriate tests of significance were employed.

Results: Among 226 study subjects, 174 (76.9%) at low risk, 36 (15.9%) at moderate risk and 16 (7.0%) were at high risk of developing major cardiovascular event in the next ten years. Risk factors such age above 50 years, male gender, presence of hypertension or diabetes and smoking were found to be significantly associated with increased risk of the predicted major cardiovascular event.

Conclusions: WHO/ISH chart is a useful tool in identifying individuals at high-risk of cardiovascular disease (CVD) and could help in planning appropriate strategies to mitigate the estimated CVD burden in future.

Keywords: cardiovascular diseases, Risk prediction charts, WHO/ISH.

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Introduction

For many years, diseases of infectious origin are the leading cause accounting for mortality, especially in resource-constraint settings [1]. However, in the past few decades owing to urbanization, globalization, increased life expectancy, and adoption of harmful lifestyles, non-communicable diseases (NCDs), especially cardiovascular disease (CVD) has emerged as one of the leading cause of morbidity, early death, overburdening of the public health infrastructure, and escalating direct and indirect healthcare costs throughout the world [2-4]. Non-communicable diseases are increasing and constitute a serious concern, accounting for 52% of the deaths and 38% of the disease burden in South-East Asia region. It is estimated that 80% of total deaths due to NCDs occur in the low-income countries [1]. By 2020, cardiovascular disease will be the largest causes of disability and death, as a proportion of all deaths in India [2]. CVD generally results from the interplay of a wide range of genetic, socio-economic, individual, physician-related, environmental factors, and healthcare delivery system-related factors [2, 3, 5].

In view of the interplay of multiple factors in the etiology of CVDs, it will be wrong to adopt a single risk factor for predicting cardiovascular risk [6]. In fact, the best approach will be to adopt a particular risk chart which considers a maximum number of all probable determinants so that the contribution of each of the risk factors can be ascertained in different regions [7]. The total risk approach was initially implemented in the developed nations and subsequently they have been employed in other parts of the world after adjustments [8]. The World Health Organization (WHO) and the International Society of Hypertension (ISH) have formulated CVD risk prediction charts for use in different sections of the globe using the best available mortality and risk factor data [9]. The proposed chart is a cost-effective tool to stratify the entire population using a risk score and thus presents a ten-year risk of major cardiovascular outcome in 14 of the WHO epidemiological sub-regions. Hence, it is a useful tool to counsel patients to modify their lifestyles or comply with their medicines [9]. We have adopted WHO/ISH cardiovascular risk prediction charts in the current study and not the General Framingham Risk Profile (GFRP) because of the augmentation of risk in wide group of population [10]. The WHO/ISH charts are designed to aid the clinicians in implementing timely preventive measures to improve the life expectancy, quality of life of the risk groups and reduction in the burdening of the health system [10]. Studies on CVD risk assessment are sparse in the proposed study setting.

This research was conducted to assess the ten-year risk of fatal or non-fatal cardiovascular event using WHO-ISH risk prediction chart among adult patients attending medicine Outpatient Department (OPD) in a tertiary care hospital.

Materials and methods

A cross sectional study was conducted among patients visiting a tertiary health care centre in Puducherry, an union territory in India, from April 2018 to June 2018. Adult patients who were General Medicine OPD attendees aged 40 or above years were included. Those patients with pre-existing cardiovascular diseases were excluded. Around 226 study subjects volunteered for the study.

WHO/ISH risk prediction chart applicable for Indian population was used as a study tool to predict ten-year risk of fatal or non-fatal major cardiovascular events [9]. This chart is of two types, depending upon the availability of blood cholesterol measurements. The chart that can be deployed in resource constrained settings, in the absence of blood cholesterol levels, was used in the present study. This study tool collects information regarding age, gender, diabetes mellitus, hypertension, smoking status of the study participants and plots it in colour coded charts, thereby predicting the risk of the subject encountering a major cardiovascular event, ten years later.

The purpose of the study was explained to the study subjects and informed consent was obtained from them before the start of the study. Blood pressure measurements were recorded as per standardized procedure for each patient using a mercury sphygmomanometer, after checking for zero error [11].

The data collected was subjected to double data entry in MS excel by two independent data entry operators and were matched for any discrepancies. The data was then analyzed using SPSS version 20.0. Descriptive statistics using frequencies and

percentages were calculated for categorical data. Chi-square test or Fisher's exact test, whichever applicable, were employed for testing association between qualitative variables. A p value below 0.05 was considered as statistically significant. Ethical approval was obtained from the Institute Ethics Committee before the start of the study.

Operational definitions

Smoking was defined as the use of any smoke form of tobacco product in the last six months [11]. Study participants were classified as diabetics based on the guidelines proposed by Indian Council of Medical Research (ICMR) [fasting blood sugar (>125 mg/dL) and/or postprandial blood sugar (>200 mg/dL)] [12, 13]. Furthermore, those individuals who were under treatment with oral hypoglycemic agents/ insulin were also labelled as diabetic irrespective of their blood glucose status. Subjects were diagnosed to be hypertensive (if systolic blood pressure ≥140 mm Hg and/or diastolic blood pressure ≥90 mm Hg or taking antihypertensive medication).

Blood pressure was measured using a digital blood pressure monitor (Omron, SEM-1, Japan) by using the oscillometric technique as recommended by NCD surveillance of Integrated Disease Surveillance Project (IDSP), Government of India. It was measured in right upper limb in supine position or sitting on a chair with back straight and with arm resting on a table at the level of the heart with appropriate size cuff. The first reading of blood pressure was taken after 5 minutes of rest and the second reading was taken at the end of interview, i.e., after 10 minutes. The second reading was taken as the final reading [14].

The ten year risk of a fatal or non-fatal cardiovascular event was classified based on the scores obtaining by plotting the collected data in the WHO/ISH risk prediction chart. The risk was classified as low, moderate or high when the score was below 10, 10 to 20 or above 20 respectively [9].

Results

A total of 226 study subjects were assessed for the cardiovascular risk factor profiling using WHO-ISH charts. The mean (±SD) age of the study subjects was 55.5 (±8.15) years. About 128 (56.6%) of them were females and 98 (43.4%) were males. Majority of the study participants were aged between 51 to 60 years (50.4%) (Table 1). Among the study population, patients already diagnosed as diabetics were 134 (59.3%) of which 58 (43.3%) were males and 76 (56.7%) were females. Similarly, known hypertensive were 130 (57.5%) of which 58 (44.7%) were males and 72 (55.3%) were females. Study subjects who were currently smoking tobacco were 40 (17.7%) and all of them were men (Table 1).

Table 1: Baseline profile of study subjects by gender (n=226).

Variable		*Male n (%)*	*Female n (%)*	*Total n (%)*
Age (years)	40-50	32 (43.2)	42 (56.8)	74 (32.7)
	51-60	48 (42.1)	66 (57.9)	114 (50.4)
	61-70	18 (47.4)	20 (52.6)	38 (16.8)
Diabetes mellitus		58 (43.3)	76 (56.7)	134 (59.3)
Hypertension		58 (44.7)	72 (55.3)	130 (57.5)
Smoker		40 (40.8)	0 (0)	40 (17.7)

Plotting the study variables in the WHO/ISH charts revealed that out of 226 study subjects, 174 (76.9%) had low risk , 36 (15.9%) had moderate risk and 16 (7.0%) had high risk of developing a fatal or non-fatal cardiovascular event in the next ten years (Table 2).

Table 2: Ten – year risk of a fatal or non-fatal cardiovascular event according to WHO/ISH risk prediction chart (n=226).

Risk	*Frequency*	*Percentage*
Low	174	76.9
Moderate	36	15.9
High	16	7.0

An increasing age, male gender, presence of raised systolic blood pressure (>140 mm/hg), pre-existing diabetes, and current smoking status were found to be significantly associated with a ten year risk of a fatal or non-fatal cardiovascular event (Table 3).

Discussion

The present study observed that 76.9% of the individuals had low risk, 15.9% had moderate risk and 7.0% of them had high risk of developing a

Table 3: Association of various factors with ten – year cardiovascular event risk (n=226).

Variables		*Low n (%)*	*Moderate n (%)*	*High n (%)*	*p value*
Gender	Male	68 (39.1)	16 (44.5)	14 (87.5)	<0.00[a]
	Female	106 (60.9)	20 (55.5)	2 (12.5)	
Age (years)	40-50	64 (36.7)	6 (16.7)	4 (25.0)	<0.00[a]
	51-60	94 (54.1)	14 (38.8)	6 (37.5)	
	61-70	16 (9.2)	16 (44.5)	6 (37.5)	
Raised SBP	present	78 (44.8)	36 (100.0)	16 (100.0)	<0.00[b]
	absent	96(55.2)	0 (0.0)	0 (0.0)	
Diabetes mellitus	present	94 (54.02)	28 (77.7)	12 (75.0)	0.01[a]
	absent	80 (45.8)	8 (22.3)	4 (25.0)	
Smoking	present	20 (11.5)	8 (22.2)	12 (75.0)	<0.00[a]
	absent	154 (88.5)	28 (77.8)	4 (25.0)	

[a]Test of significance = Chi-square test; [b]Test of significance = Fisher's exact test.

fatal or non-fatal cardiovascular event in ten years, as per the risk prediction charts. Similar findings were observed by researchers elsewhere in India. Ghorpade et al, in their study done in the rural field practice area of a medical college in South India reported that 83.0% individuals had low risk (i.e., below 10%), 6.8% and 10.2% subjects had moderate (i.e., 10% to 20%) and high risk (i.e., above 20%) of CVD-related outcome respectively [15]. The study was done in the community and among both diabetics as well as non-diabetics.

Savitharani et al, in their study done among support staff of a tertiary hospital in Mysuru reported that 98.3% of participants had a ten – year risk of <10% [16]. The fact that only 3.3% of participants in this study had hypertension and 2.2% were known cases of diabetes mellitus on treatment could have contributed to the large percentage under low cardiovascular risk. This in contradiction to the finding in the present study that 59.3% of the participants had hypertension and 57.5% participants were known case of diabetes mellitus.

The differences between prevalence of diabetes mellitus among males were around 43.3% and females with diabetes were 56.7% which is in contradiction to the study by Kadiyala P et al in Karnataka that reported diabetic males were 18.8% and females were 11.2% [17]. In our study there were very high proportion participants ailing with diabetes and hypertension. This may be because most of the patients visit our institution to have regular check-ups during the respective NCD clinics.

In our present study prevalence of low, moderate and high cardiovascular risk in men were 39.0%, 44.4%, and 87.5% respectively as compared to women being 60.9%, 55.5%, 12.5% respectively. This is supported by study done by Shrivastava et al in rural Puducherry who reported that the study prevalence of low, moderate and high cardiovascular risk in men were 82.7%, 12.8% and 4.5% as compared to female were 88.8%, 5.9% and 5.3% respectively [18]. Nordet et al, in their study done on total cardiovascular risk assessment and management in Cuba showed significant differences that males had more risk of fatal and non-fatal CVD and stroke as compared to females [19].

The present study identified that raised systolic blood pressure, known case of diabetes and smoking as significant factors associated with CVD risk. Similarly, a study done in rural Nepal also identified that diabetes and raised systolic blood pressure as strong CVD risk factor [20]. Another study done by Norhayati et al showed that diabetes and hypertension played a main role in influencing cardiovascular risk [21].

Conclusion

Categorizing the risk of the individual is one of the crucial steps to mitigate the magnitude of fatal or non-fatal cardiovascular event. WHO-ISH risk predication chart can be used as a tool to predict cardiovascular diseases risk in a low-cost resources settings among asymptomatic individuals.

Recommendation

As the WHO-ISH charts yield useful information, these can be used by the doctors in the OPD not only to plan treatment goals for the patients but also to educate patients about their risk status. On the other hand, these charts can be of immense use to the institution to estimate the number of major cardiovascular events averted over a period of time and the kind of services the hospital needs to be equipped within the near future.

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Conflicts of interest

The authors declare that there are no existing conflicts of interest.

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